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median line, — that have given him the name of tesselated darter, said by the books to be "common." But Boleosoma is a braver name, and we even prefer "Boly," for short. The head resembles that of Diplesium, but the habit of leaning forward over a stone, resting on the front fins, gives a physiognomy even more frog-like; his actions however, are, rather bird-like, for he will strike attitudes like a tufted titmouse, and he flies rather than swims through the water. He will with much perseverance push his body between a plant and the side of the aquarium, and balance himself on the slender stem. Crouching cat-like before a snail-shell, he will snap off the horns which the unlucky owner pushes timidly out. But he is often less dainty, and, seizing the animal by the head, dashes the shell against the glass or a stone until he pulls the body out or breaks the shell. "Boly," alas! is the "Quaker of our aquarium" only in appearance.

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THE BLACK KNOT.

THE following article is an abstract, by Mr. B. D. Halsted, of a paper by Prof. W. G. Farlow published in the Bulletin of the Bussey Institution of March, 1876. It will be the endeavor to give, with the aid of two of the three original plates,[1] a brief notice of the most important points concerning this destructive fungus.

Without doubt, the most striking disease of vegetable origin occurring on fruit-trees in this country is that commonly known as the black knot. The disease takes its name from the unsightly, black, wart-like excrescences, with which every one is familiar, on plum-trees and different kinds of wild and cultivated cherries. It is found in all parts of our country east of the Rocky Mountains, and is so common and destructive that in some districts one seldom sees a plum-tree free from the knot. An idea may be formed of the small crop of plums now raised in New England from the fact that two dollars and a half were given in Boston last autumn for a peck of damsons for preserving. In some parts of New England, particularly in Maine and along the sea-coast, the raising of cherries has also been almost abandoned, in consequence of the ravages of the black knot. The disease is peculiar to America, and has been the bane of fruit-growers from early times; but although much has been written in agricultural papers about its injury to the fruit crop, the subject has been almost entirely neglected by botanists. In the present paper we shall consider the cause and prevention of the knot, and the question whether the disease is the same on plums and cherries. As a preliminary step, it will be well to trace the development of the knot as it occurs on a single species, and for this purpose the choke-cherry, *Prunus Virginiana* L., may be selected.

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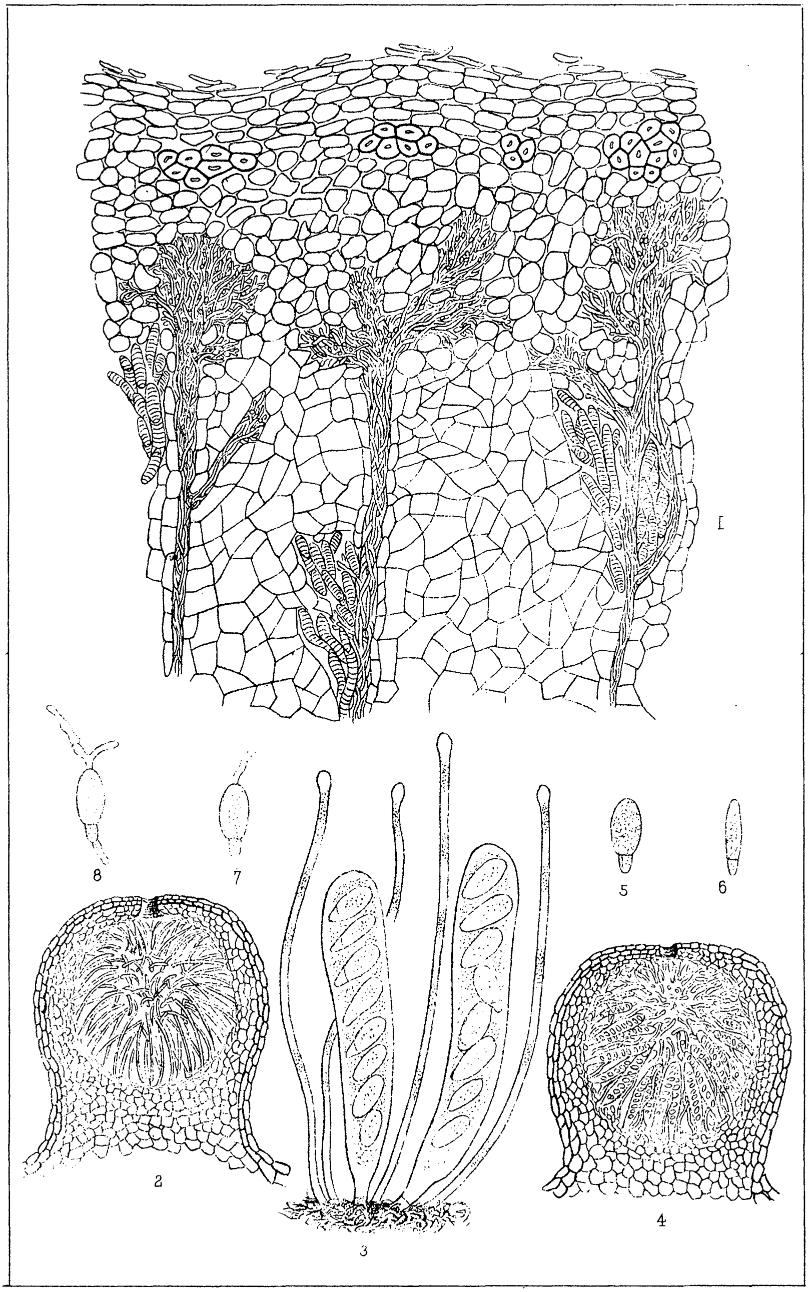
[1] The sum of $500 was voted by the Trustees of the Massachusetts Society for Promoting Agriculture to aid Professor Farlow in his researches, and from this liberal appropriation the expense of the plates was defrayed. Professor Farlow is himself responsible for the microscopic details of the plates, but whatever of beauty they may possess is entirely due to the skill of Mr. J. H. Blake, of the Museum of Comparative Zoölogy, Cambridge.

The size of the knots varies greatly, being found on the species of *Prunus* under consideration all the way from a few lines to several inches in length, with an average of two inches in circumference. The knot does not usually entirely surround the branch, but growing from one side, often causes the branch to bend or twist into an irregular shape. In the winter, when the branches are leafless, the knots are much more noticeable, and at this season they are often cracked and broken, worm-eaten and hollow.

In the swollen portions of the branch above and below the knot, sections under the microscope show the vegetative portion of the fungus in the form of minute threads, .0007 mm. in diameter, twisted together and extending from the cambium towards the outer portion of the stem, where they become separated as shown in Plate IV., Figure 1. The fungus first reaches the cambium either by the germination of spores on the surface of the branch, or by the mycelium proceeding from a neighboring knot. The part of the cambium free from these bundles of mycelial threads grows in the usual manner, and in an old branch a cross section shows at the end of the season one more "ring" or layer of wood on the sound than on the diseased side. From this it is to be concluded that the growing layer of tissue of the plum or cherry branch is the place from which the fungus begins its destructive work.

In the spring the swollen portion of the branch, whether it be on either side of an old knot or at the beginning of a new one, increases in size, and the mycelium soon reaches and bursts through the bark, so that by the time the choke-cherry is in flower the knot has reached nearly its full size, though differing from an old one in being still greenish in color and solid or pulpy in consistency.

PLATE IV.



Thos Sinclair & Son, lith. Phila

" With a hand-lens one can see small hemispherical protuberances, which are the beginnings of the 'perithecia.' The whole surface of the protuberances is covered with filaments (Plate III., Figure 2) about .04 mm. to .06 mm. in height and .004 mm. in breadth, which are somewhat flexuous and frequently divided by cross-partitions. The filaments are more frequently simple, but sometimes branch. At the tip of the terminal joint, or more frequently a little to one side, is borne a spore .006 mm. in length, ovate and rather sharply pointed at the lower end. Not unfrequently two or three spores are borne on the upper joint, and others may also be produced on some of the lower joints. We have never seen any cross divisions in the conidial spores, which fall very early from their attachments. The conidia which we have just described spring directly from the surface of the perithecia.· They continue to bear their spores until the latter part of summer, when they begin to dry up, and as winter sets in one finds only their shriveled remains." As autumn approaches, the knots assume their black color, the inner portions being either destroyed by insects or reduced to a powdery mass, with only the hard outer shell, which contains the perithecia, left in place. These perithecia are small pits or sacs which are scattered through the hard crust and contain the sexual spores, borne, always to the number of eight, in asci or cells. In Plate IV., Figure 4, is shown a highly magnified cross section through a perithecium, with the spore sacs attached to the wall. Figure 3 of the same plate gives a still more magnified view of two of the asci, with the spores somewhat regularly disposed ; while springing from the wall of the perithecium and extending above the asci are the long and slender sterile threads called " paraphyses." " The asci grow slowly during the winter, and about the middle of January the spores begin to ripen. In the month of February they are found in perfection; but late in spring they are not so abundant or in such good condition. We first found a few ripe spores on the 17th of January ; and in the second week of February, most of the knots examined contained ripe spores. . . . . The spores measure from .016 mm. to .02 mm. in length and from .008 mm. to .01 mm. in breadth. They are two-parted, as shown in Plate IV., Figures 5 and 6 ; one division being uniformly much smaller than the other, and not more than one quarter or one third as long. The spores are transparent and slightly granular. As they lie in the ascus, the small end almost invariably points downwards. Spores which ripen in February germinate in the course of from three to five days, when sufficiently moist."

Besides the conidial spores formed from the outside, and the ascospores from the inside, of the wall of the perithecia, there are still other forms of fruit, which are called stylospores. These spores are produced in cavities between the perithecia; a cross section of such a cavity is represented in Plate III., Figure 4, with a small portion more magnified in Figure 5, showing these bodies to be borne on long stalks and divided by partitions into four parts.

"Plate IV., Figure 2, represents a section through a cavity hardly distinguishable externally from the perithecia, which, instead of being filled with asci, is lined with slender filaments whose tips are somewhat incurved, and easily broken off, the central part of the sac being filled with them. We call these "spermogonia," from their resemblance to the bodies of the same name in lichens. They are much less common than the conidia or stylospores. Interspersed amongst the ascus-bearing perithecia, one finds tolerably frequently still other cavities which are much more flattened than the perithecia, which often, instead of appearing oval, on section seem almost triangular. They are lined with short, delicate filaments which end in a minute oval hyaline body. These small oval bodies are produced in immense numbers, and are discharged not singly, but in masses. They are more or less closely held together by a sort of jelly, and ooze out from the cavity in which they are produced in the form of tendrils reminding one of the toy called "Pharaoh's serpent." This last form is called the "pycnidia." It seems that this fungus does not lack for methods of propagating itself and continuing its species.

The knot on the choke-cherry, when compared with those on the plum and cultivated varieties of cherry, is seen to be slightly different in general appearance; but when viewed with the microscope they all prove to be identical, the difference noticeable to the naked eye being due to more favorable circumstances for its growth afforded by one species of *Prunus* than by another. On the plum it does not thrive as well as on the choke-cherry. The curculio deposits its eggs in the young pulpy knot, and from the punctures a gum soon exudes and on this coating a mold, *Trichothecium roseum* Lk., quickly develops, giving a peculiar pinkish color to the knot. "It is probably owing to the fact that the curculio stings the knots that so many persons have been led to believe that the knots themselves are of insect origin."

Schweinitz was the first to describe, under the name of *Sphæria morbosa*, the fungus causing the black knot. At that time nothing was known of the secondary forms of fruit of this group of fungi. Mr. C. H. Peck was the first to describe the conidia.

From a short discussion as to the position this species should take in classification and the name it ought to bear, it is concluded that until its related species are better known its old place and name had best be retained.

The black knot is far from being of recent origin, and has furnished a subject about which vastly more has been written than was known. Many, especially the early writers, held it to be of insect origin, while, later, others have looked upon it as a vegetable growth, and still others included in its production the actions of both these forms of life. During the last thirty years the insect theory has been gradually given up by the entomologists; but it still remains for many fruit-growers to accept the knot as being of fungus origin. The proof given in the paper is very conclusive on this long-disputed point. " First, the knots do not resemble the galls made by any known insect. Secondly, although insects, or remains of insects, are generally found in old knots, in most cases no insects at all are found in them when young. Thirdly, the insects that have been found by entomologists in the knots are not all of one species, but of several different species, which are also found on trees which are never affected by the knot. On the other hand, we never have the black knot without the *Sphæria morbosa*, as was admitted by Harris; and the mycelium of that fungus is found in the slightly swollen stem long before anything which could be called a knot has made its appearance. Furthermore, the *Sphæria morbosa* is not known to occur anywhere except in connection with the knots."

Those who believe that there are two distinct species of the knot have arrived at this conclusion from a too hasty generalization upon incomplete observations. " Having seen some cherries free from the knot, although growing near diseased plum-trees, and others, perhaps not near any plum-trees, covered with knots, they have jumped at the conclusion that there must be two different fungi producing the knot: one on the cherry, derived from the wild cherry; another on the plum, derived from the wild plum." This false inference comes from the fact that some species of wild cherry, and also some cultivated varieties, are not attacked by the knot. " *Prunus serotina* Ehr., the rum-cherry, and *Prunus Virginiana* L., the choke-cherry, are about equally common near Boston. The latter is very frequently attacked by the knot; the former never, as far as our experience goes, and we have examined hundreds of trees." In and around Boston the cultivated plum has been nearly destroyed by the knot, while over the same territory the wild plum is of rare occurrence, if found at all, showing that the disease must come from some species of cherry.

In all this long discussion of the black knot much confusion has grown out of the loose use of popular names. The choke-cherry of one person may not be the choke-cherry of another; and the bird or rum cherry in one section may bear other names in another part of the country.

With a knowledge of the nature of this contagious disease the remedy at once suggests itself: namely, to cut off the knots, together with the swollen portions of the branches, wherever and whenever they are found. In autumn, as soon as the leaves fall, the knots can be most easily seen, and all branches bearing them should be taken off and burned at once. Though the ascospores are not formed until late in the following winter, it was carefully observed that, were the knots left undestroyed, they would ripen after the branch was cut from the tree. The choke-cherry, bird-cherry, and wild plum furnish means for rapid propagation of the knot, and they should be gladly sacrificed for the good of their more worthy allies. Of the choke-cherry the writer says, "However opinions may differ as to its beauty, there can be only one as to its injurious influence on cherry and plum orchards; and it cannot be too strongly impressed upon fruit-growers that the choke-cherry is a most dangerous enemy, and should be destroyed."

Knowing the cause, nature, and means of propagation of the black knot, it remains for the fruit-growers to profit by their valuable instruction and use their best endeavors to destroy this pest. The article closes with a statement of the importance of keeping the disease within its present bounds. It is now peculiar to America, and any means of introducing it into other countries should be strenuously avoided.

EXPLANATION OF THE PLATES.

Plate III. Figure 1. *Sphæria morbosa* on the cultivated plum, as seen in autumn, natural size.

Figure 2. Section of knot on the choke-cherry in May, magnified six hundred diameters; *a*, mycelium; *b*, conidia.

Figure 3. Conidia more highly magnified.

Figure 4. Section through one side of a cavity containing stylospores. From mazzard cherry.

Figure 5. Stylospores more highly magnified.

Plate IV. Figure 1. Section of choke-cherry stem, showing the mycelium before it has come to the surface, magnified six hundred diameters.

Figure 2. Spermogonia.

Figure 3. Asci and spores of *Sphœria morbosa* from the choke-cherry.

Figure 4. Perithecium with asci.

Figures 5, 6. Ripe ascospores.

Figures 7, 8. Ascospores germinating.

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PROFESSOR TYNDALL ON GERMS.

UNDER this head, *Nature* gives an abstract of a paper read by Professor Tyndall before the Royal Society, January 13th, entitled On the Optical Deportment of the Atmosphere in Reference to the Phenomena of Putrefaction and Infection. Among other things, he wished to free his mind, and if possible the minds of others, from the uncertainty and confusion which now beset the doctrine of "spontaneous generation." Pasteur has pronounced it "a chimera," and expressed the undoubting conviction that, this being the case, it is possible to remove parasitic diseases from the earth. We make a few extracts from this interesting article: —

"To the medical profession, therefore, and through them to humanity at large, this question is one of the last importance. But the state of medical opinion regarding it is not satisfactory. In a recent number of the *British Medical Journal*, and in answer to the question, 'In what way is contagium generated and communicated?' Messrs. Braidwood and Vacher reply that notwithstanding 'an almost incalculable amount of patient labor, the actual results obtained, especially as regards the manner of generation of contagium, have been most disappointing. Observers are even yet at variance whether these minute particles, whose discovery we have just noticed, and other disease germs, are always produced from like bodies previously existing, or whether they do not, under certain favorable conditions, spring into existence *de novo*.' . . .

"The result of the experiments showed that infusions of various substances exposed to the common air of the Royal Institution laboratory, maintained at a temperature of from 60° to 70° Fahr., all fell into putrefaction in the course of from two to four